Identification and Evaluation of Viable Remediation Alternatives to address Injuries related to Land Disposal of Poultry Waste within the Illinois River Watershed

Prepared by:

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My fee for this work is $175 per hour in accordance with the contract terms and conditions between Motley-Rice and CDM.

I have not provided depositions or expert testimony in the previous four years.

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Reduction of toxicity, mobility, or volume through treatment – This technology would not reduce toxicity, mobility or volume of N, P or bacteria.

Short-term effectiveness – Replacement would be effective in the short-term. No human health risks are associated with well replacement.

Implementability – The implementability of this technology is limited to those areas where a deeper, uncontaminated aquifer zone is available.

Costs – Costs of this technology are estimated as follows: capital costs for 190 new wells (N only) and 980 new wells (N plus bacteria) were estimated at $5.8 and 30 million, respectively; annual costs were estimated to be similar to existing wells and set to zero, which resulted in the total present worth cost over 30 years to be estimated at $5.8 and 30 million, respectively.

4.4 Riverine Response Region

Due to the nature of the rivers within IRW, namely coarse sediments with little fines, remedial technologies that might address P removal were screened out based on limited ability to achieve remedial goals. However, drinking water treatment of public water supplies drawing from IRW rivers was retained based on its effectiveness in addressing human health risks related to disinfection byproducts.

4.4.1 Treatment – Drinking water surface water treatment

Organic matter is correlated with precursors that form DBPs when drinking water is disinfected. The formation of disinfection byproducts such as THMs and HAA5s can be reduced by using enhanced coagulation, softening or granular activated carbon (GAC) to remove these precursors. This is usually used in systems using conventional filtration treatment (US EPA Office of Water, 2001).

Overall protection of human health and the environment – Treating water supplies contaminated with DBPs would reduce the risk of human ingestion. These disinfection by-products are considered probable human carcinogens by US EPA.

Compliance with potentially applicable legal requirements –

- Safe Drinking Water Act (40 CFR part 143). Public water systems are regulated under federal standards of SDWA. Remediation would need to be in compliance with these standards.

- The Stage 2 DBP rule (40 CFR, parts 9, 141 and 142). Remediation would put drinking water systems in compliance with this rule, which specifically addresses DBPs.

Long-term effectiveness and permanence – Treatment for DBPs with proper operation and maintenance are effective in the long term and permanent.

Reduction of toxicity, mobility, or volume through treatment – Treating drinking water supplies for DBPs would reduce the risks of these probable human carcinogens from being ingested. However it does not address the excess P in the IRW that is causing the eutrophication.

Short-term effectiveness – The initial implementation of this remediation would not have a detrimental effect on human health or the environment.

Implementability – Technologies to reduce DBPs are implementable and readily available.

Costs – Costs of this technology were estimated based on US EPA published estimates provided as part of the Federal Register when the disinfection byproduct rule was promulgated (FR Vol 71, No. 2, January 4, 2006 p. 456). Costs were escalated from 2003 dollars to 2008 dollars using the Engineering News-Record Construction Cost Index History. Four water treatment plants (WTPs) used the Illinois River for source water while one WTP used Baron Fork Creek. Capital costs for all five WTPs were estimated at a total of $220 million; annual costs were estimated to be $19 million in aggregate; and the total present worth cost over 30 years for this technology was estimated at $452 million.

4.5 Lake Tenkiller Response Region

Several remedial technologies were preliminarily retained from the screening process for the Lake Tenkiller response region. However, additional investigation and assessment will be required to determine their effectiveness and potential value in meeting remedial goals. Therefore, drinking water treatment of public water supplies drawing from Lake Tenkiller was retained based on its effectiveness in addressing human health risks related to disinfection byproducts.

4.5.1 Treatment - Drinking water surface water treatment

Organic matter is correlated with precursors that form DBPs when drinking water is disinfected. The formation of DBPs can be reduced by using enhanced coagulation, softening or granular activated carbon (GAC) to remove these precursors. This is usually used in systems using conventional filtration treatment (US EPA Office of Water, 2001).

Overall protection of human health and the environment – Treating water supplies contaminated with DBPs would reduce the risk of human ingestion. These disinfection by-products are considered probable human carcinogens by US EPA.

Compliance with potentially applicable legal requirements –

- Safe Drinking Water Act (40 CFR part 143). Public water systems are regulated under federal standards of SDWA. Remediation would need to be in compliance with these standards.

- The Stage 2 DBP rule (40 CFR, parts 9, 141 and 142). Remediation would put drinking water systems in compliance with this rule, which specifically addresses DBPs.

Long-term effectiveness and permanence – Treatment for DBPs with proper operation and maintenance are long term effective and permanent.

Reduction of toxicity, mobility, or volume through treatment – Treating drinking water supplies for DBPs would reduce the risks of these probable human carcinogens from being ingested. However it does not address the excess P in the IRW that is causing the eutrophication.

Short-term effectiveness – The initial implementation of this remediation would not have a detrimental effect on human health or the environment.

Implementability – Technologies to reduce DBPs are implementable and readily available.

Costs – Costs of this technology were estimated based on US EPA published estimates provided as part of the Federal Register when the disinfection byproduct rule was promulgated (FR Vol 71, No. 2, January 4, 2006 p. 456). Costs were escalated from 2003 dollars to 2008 dollars using the Engineering News-Record Construction Cost Index History. Fourteen water treatment plants (WTPs) use Lake Tenkiller for source water. Capital costs for all fourteen WTPs were estimated at a total of $233 million; annual costs were estimated to be $28 million in aggregate; and the total present worth cost over 30 years for this technology was estimated at $583 million.

TABLE 7

Summary of Costs for Remedial Alternatives
Illinois River Watershed

PRELIMINARY COST ESTIMATE
Tab 7-4.4.1 Treatment – Drinking water surface water treatment (IRW rivers and stream WTPs)

CAPITAL (DIRECT & INDIRECT)

	Item	Quantity	Units	Unit Cost ($)	Item Cost ($)	Comments
	Direct Costs:			Millions		
1	OK1021701 TAHLEQUAH PWA - Illinois River	1	Lump Sum	$ 82.28	$82,277,741	WTP data from http://sdwis.deq.state.ok.us/
2	OK1221637 CHEROKEE CO RWD #11 - Illinois River	1	Lump Sum	$ 74.83	$74,833,104	EPA cost data from Fed Reg Vol 71, No. 2 Jan 4, 2006 p.456
3	OK1021694 FLINT RIDGE RURAL WATER DISTRICT - Illinois River	1	Lump Sum	$ 29.33	$29,331,386	ENR escalation from 2003 to 2008 = 1.2085
4	OK1021775 SEQUOYAH CO RWD # 5 - Illinois River	1	Lump Sum	$ 29.33	$29,331,386	
5	OK1021770 ADAIR CO RWD #5 - Baron Fork	1	Lump Sum	$ 4.57	$4,568,300	
				Subtotal:	$220,341,918	
				30% Contingency(2):	$0	EPA estimate assumed to include contingencies
				Total Contractor Costs:	$220,341,918	
				Engineering, Legal, Permits, Contractor OH&P(25%):	$0	EPA estimate assumed to include these costs
				Total Capital Costs:	$220,341,918	
				Rounded Total:	$220,342,000	

ANNUAL (POST-REMEDIAL SITE CONTROL)

	Item	Quantity	Units	Unit Cost ($)	Item Cost ($)	Comments
				Millions		
1	OK1021701 TAHLEQUAH PWA - Illinois River	1	Year	$ 4.06	$4,060,711	WTP data from http://sdwis.deq.state.ok.us/
2	OK1221637 CHEROKEE CO RWD #11 - Illinois River	1	Year	$ 6.45	$6,453,630	EPA cost data from Fed Reg Vol 71, No. 2 Jan 4, 2006 p.456
3	OK1021694 FLINT RIDGE RURAL WATER DISTRICT - Illinois River	1	Year	$ 4.06	$4,060,711	ENR escalation from 2003 to 2008 = 1.2085
4	OK1021775 SEQUOYAH CO RWD # 5 - Illinois River	1	Year	$ 4.06	$4,060,711	
5	OK1021770 ADAIR CO RWD #5 - Baron Fork	1	Year	$ 0.74	$737,212	
				Subtotal:	$18,635,763	
				30% Contingency(2):	$0	EPA estimate assumed to include contingencies
				Total:	$18,635,763	
				30-Year Present Worth Cost (3):	$231,251,955	
				Rounded Total:	$231,252,000	

Total Project Present Worth Cost:	$451,594,000

Notes:

1. Unit cost shown includes material and labor costs unless otherwise noted.
2. A 30% contingency is included provide for unexpected circumstances or variability in estimate areas, volumes, labor and material costs. Contingency allowance developed based upon USEPA, 19
3. 30-year present worth based on a 7.0 percent discount rate as published in USEPA, 1993c, and has been applied to Annual/O&M Costs

TABLE 8

Summary of Costs for Remedial Alternatives
Illinois River Watershed

PRELIMINARY COST ESTIMATE
Tab 8-4.5.1 Treatment - Drinking water surface water treatment (Lake Tenkiller WTPs)

CAPITAL (DIRECT & INDIRECT)

	Item	Quantity	Units	Unit Cost ($)	Item Cost ($)	Comments
	Direct Costs:			Millions		
1	OK1020210 SEQUOYAH COUNTY WATER ASSOC	1	Lump Sum	$ 82.28	$82,277,741	WTP data from http://sdwis.deq.state.ok.us/
2	OK1021721 CHEROKEE CO RWD #13	1	Lump Sum	$ 29.33	$29,331,386	EPA cost data from Fed Reg Vol 71, No. 2 Jan 4, 2006 p.456
3	OK1021773 GORE PWA	1	Lump Sum	$ 29.33	$29,331,386	ENR escalation from 2003 to 2008 = 1.2085
4	OK1021711 CHEROKEE CO RWD # 2 (KEYS)	1	Lump Sum	$ 29.33	$29,331,386	
5	OK1021713 EAST CENTRAL OKLA WATER AUTH	1	Lump Sum	$ 29.33	$29,331,386	
6	OK1021756 TENKILLER UTILITY CO	1	Lump Sum	$ 4.57	$4,568,300	
7	OK1021707 LRED (CHICKEN CREEK)	1	Lump Sum	$ 3.89	$3,891,515	
8	OK1021731 LRED (LAKEWOOD)	1	Lump Sum	$ 3.89	$3,891,515	
9	OK1021703 LRED (WILDCAT)	1	Lump Sum	$ 3.89	$3,891,515	
10	OK1021727 LRED (WOODHAVEN)	1	Lump Sum	$ 3.89	$3,891,515	
11	OK1021730 FIN & FEATHER RESORT	1	Lump Sum	$ 3.89	$3,891,515	
12	OK1021745 TENKILLER AQUA PARK	1	Lump Sum	$ 3.89	$3,891,515	
13	OK1021763 BURNT CABIN RWD	1	Lump Sum	$ 3.89	$3,891,515	
14	OK1021702 PETTIT MT WATER	1	Lump Sum	$ 1.29	$1,293,143	

Subtotal:	$232,705,333	
30% Contingency(2):	$0	EPA estimate assumed to include contingencies
Total Contractor Costs:	$232,705,333	
Engineering, Legal, Permits, Contractor OH&P(25%):	$0	EPA estimate assumed to include these costs
Total Capital Costs:	$232,705,333	
Rounded Total:	$232,705,000	

ANNUAL (POST-REMEDIAL SITE CONTROL)

	Item	Quantity	Units	Unit Cost ($)	Item Cost ($)	Comments
				Millions		
1	OK1020210 SEQUOYAH COUNTY WATER ASSOC	1	Year	$ 4.06	$4,060,711	WTP data from http://sdwis.deq.state.ok.us/
2	OK1021721 CHEROKEE CO RWD #13	1	Year	$ 4.06	$4,060,711	EPA cost data from Fed Reg Vol 71, No. 2 Jan 4, 2006 p.456
3	OK1021773 GORE PWA	1	Year	$ 4.06	$4,060,711	ENR escalation from 2003 to 2008 = 1.2085
4	OK1021711 CHEROKEE CO RWD # 2 (KEYS)	1	Year	$ 4.06	$4,060,711	
5	OK1021713 EAST CENTRAL OKLA WATER AUTH	1	Year	$ 4.06	$4,060,711	
6	OK1021756 TENKILLER UTILITY CO	1	Year	$ 0.74	$737,212	
7	OK1021707 LRED (CHICKEN CREEK)	1	Year	$ 0.99	$991,007	
8	OK1021731 LRED (LAKEWOOD)	1	Year	$ 0.99	$991,007	`
9	OK1021703 LRED (WILDCAT)	1	Year	$ 0.99	$991,007	
10	OK1021727 LRED (WOODHAVEN)	1	Year	$ 0.99	$991,007	
11	OK1021730 FIN & FEATHER RESORT	1	Year	$ 0.99	$991,007	
12	OK1021745 TENKILLER AQUA PARK	1	Year	$ 0.99	$991,007	
13	OK1021763 BURNT CABIN RWD	1	Year	$ 0.99	$991,007	
14	OK1021702 PETTIT MT WATER	1	Year	$ 0.24	$241,709	

Subtotal:	$28,219,525	
30% Contingency(2):	$0	EPA estimate assumed to include contingencies
Total:	$28,219,525	
30-Year Present Worth Cost (3):	$350,177,247	
Rounded Total:	$350,177,000	

Total Project Present Worth Cost:	$582,882,000

Notes:

1. Unit cost shown includes material and labor costs unless otherwise noted.
2 A 30% contingency is included provide for unexpected circumstances or variability in estimate areas, volumes, labor and material costs. Contingency allowance developed based upon USEF
3 30-year present worth based on a 7.0 percent discount rate as published in USEPA, 1993c, and has been applied to Annual/O&M Costs